THE JOURNAL OF NAVIGATION (2010), **63**, 167–182.
doi:10.1017/S037346330999021X

Decision Support from Genetic Algorithms for Ship Collision Avoidance Route Planning and Alerts

Ming-Cheng Tsou[1], Sheng-Long Kao[1] and Chien-Min Su[2]

[1] (*National Taiwan Ocean University, Department of Transportation and Navigation Science*)

[2] (*National Taiwan Ocean University, Department of Electrical Engineering*)
(Email: d86228006@yahoo.com.tw)

When an officer of the watch (OOW) faces complicated marine traffic, a suitable decision support tool could be employed in support of collision avoidance decisions, to reduce the burden and greatly improve the safety of marine traffic. Decisions on routes to avoid collisions could also consider economy as well as safety. Through simulating the biological evolution model, this research adopts the genetic algorithm used in artificial intelligence to find a theoretically safety-critical recommendation for the shortest route of collision avoidance from an economic viewpoint, combining the international regulations for preventing collisions at sea (COLREGS) and the safety domain of a ship. Based on this recommendation, an optimal safe avoidance turning angle, navigation restoration time and navigational restoration angle will also be provided. A Geographic Information System (GIS) will be used as the platform for display and operation. In order to achieve advance notice of alerts and due preparation for collision avoidance, a Vessel Traffic Services (VTS) operator and the OOW can use this system as a reference to assess collision avoidance at present location.

KEY WORDS

1. genetic algorithm. 2. collision avoidance. 3. decision support system. 4. GIS.

1. INTRODUCTION. With the continued development of the shipping industry, ships have grown larger, become more specialized and capable of operating at faster speeds. The marine traffic environment has become more complicated and the density of shipping traffic has become greater. The navigable areas in channels and ports have become relatively narrow, so that the navigation problems are more challenging and collisions or stranding accidents are increasing in frequency, even though auxiliary ship collision avoidance equipment is widely used at present. These accidents not only cause major human injury and huge property loss, but also constitute a serious threat to the marine environment. In an investigation into reasons for collision accidents it was found that over 80% are caused by human factors (Li et al., 2006).

There are two ways to solve the problem of these human factors: Firstly, to strengthen the technical training and management of crews, to improve the quality